



Environmental Engineers

me

February 8, 2013

Ms. Catherine Barrett, RPM and Project Coordinator
SUPR/MOKS
EPA Region VII
901 North 5th Street
Kansas City, Kansas 66101

Re: **Streamlined Risk Evaluation**
BLR Redevelopment Corporation
4327 Gustine Avenue
Ray Avenue Superfund Site
St. Louis, Missouri 63116

Dear Ms. Barrett:

Thank you for taking the time to discuss the Streamlined Risk Evaluation ("SRE") and closure of the above referenced site via telephone on Thursday, January 31, 2013. As discussed, a copy of the January 23, 2013 memorandum prepared by Ms. Kelly Schumacher regarding the June 1, 2012 SRE for the BLR Redevelopment Corporation ("BLR") portion of the Ray Avenue Superfund Site was recently received by this office. Based on the comments presented in this memorandum, the appropriate revisions to the June 1, 2012 SRE have been completed. Attached for your review and approval are the following revised documents:

- Page 14 of the SRE. The average exposure time for a non-carcinogen for the construction worker has been revised to 126 days; the exposure duration to 1 year.
- Page 21 and 22 of the SRE. Section 6.0 has been revised based on the revisions to Table Nos. 9 and 10.
- Table No. 9.
- Table No. 10.
- Exhibit IV (including the revisions to Equation 5-14).
- Compact Disc containing the revised spreadsheets for Table Nos. 9 and 10.

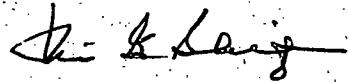
The following ~~Tables~~ Appendices are available only on CD

Tables 9 + 10

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It is our understanding that, with these revisions, the SRÉ has been completed. If you have any questions or require additional information at this time, please advise.

Sincerely yours,
SHIFRIN & ASSOCIATES, INC.



Walter G. Shifrin, P.E., President

WGS:mkh
Enclosures

cc: Mr. Harry T. Bussmann, III/BLR Redevelopment Corporation (w/o enclosures)
Ms. Kelly Schumacher/USEPA Region VII
Ms. Julie Van Horn/USEPA Region VII

• Average Time for Carcinogen (AT _c)	70 years
• Average Time for Non-Carcinogen (AT _{nc})	25 years
• Body Weight (BW)	70 kg
• Exposure Duration (ED)	25 years
• Exposure Frequency (EF)	250 days/year
• Soil Ingestion Rate (IR _{soil})	100 mg/day
• Exposure Time for Outdoor Inhalation (ET _{out})	8 hours/day
• Skin Surface Area for Dermal Contact (SA)	3300 cm ² /day
• Soil to Skin Adherence Factor (M)	0.2 mg/cm ³
• Event Frequency Dermal Contact with Soils (EV _{soil})	1 event/day
• Particulate Emission Factor (PEF)	1.36E9 m ³ /kg

Construction Worker

• Average Time for Carcinogen (AT _c)	70 years
• Average Time for Non-Carcinogen (AT _{nc})	126 days
• Body Weight (BW)	70 kg
• Exposure Duration (ED)	1 year
• Exposure Frequency (EF)	90 days/year
• Soil Ingestion Rate (IR _{soil})	330 mg/day
• Exposure Time for Outdoor Inhalation (ET _{out})	8 hours/day
• Skin Surface Area for Dermal Contact (SA)	3300 cm ² /day
• Soil to Skin Adherence Factor (M)	0.3 mg/cm ³
• Event Frequency Dermal Contact with Soils (EV _{soil})	1 event/day
• Particulate Emission Factor (PEF)	5.55E+06 m ³ /kg

The PEF for the construction worker was calculated using the following assumptions

• Q/C _{sr} (Assume a 0.5 acre site)	23.02
• Dispersion Correction Factor (F _D)	0.185
• Total Construction Time (T) 90 days 8 hours/day	2,592,000 sec
• Length of Road Segment (L _R)	50 ft
• Width of Road (W _R)	35 ft
• Mean Vehicle Weight (W) 4 cars @ 2 tons/car 6 trucks @ 20 tons/truck	12.8 tons
• Days with minimum 0.01-inches rain (p)	112 days
• Sum fleet vehicle kilometers traveled 10 vehicles (6 trucks, 4 cars) 0.01524 km/day 90 days	13.716 km

IV are the calculations to determine the chemical-specific subchronic volatilization factor for naphthalene. Because naphthalene is considered sufficiently volatile, a volatilization factor for exposure via inhalation has been utilized, as opposed to a particulate emissions factor.

The dosages and hazard quotients for each non-carcinogenic chemical of potential concern for each complete construction worker pathway are presented in Table No. 10.

SECTION 6.0 - RESULTS AND CONCLUSIONS

6.1 Current On-Site Commercial Worker

As discussed above, the risk to the current commercial on-site worker was not assessed as part of this SRE, since a majority of the site is paved and improved with buildings. The paved surfaces and building prevent the current on-site commercial worker from being exposed to the impacted surface soils.

6.2 Future On-Site Commercial Worker

The cumulative site wide IELCR for the future on-site commercial worker is 2E-03. The carcinogenic risk to the future on-site commercial worker is driven mostly by the concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene in the surficial soil interval. The sum of the IELCRs for ingestion of these chemicals (1.13E-03) and the sum of the IELCRs for dermal contact with these chemicals (9.72E-04) account for approximately 86% of the total site wide IELCR.

The concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene utilized to assess the risk to the future on-site commercial worker, both 222 mg/kg, was based on the laboratory reporting limit for the soil sample obtained at D-4 (0'-3'). However, the laboratory report estimates a concentration of 100 mg/kg of benzo(a)pyrene in this sample. No laboratory estimate for dibenzo(a,h)anthracene was reported.

Additionally, the soil concentrations for all PAHs, excepting fluoranthene and naphthalene, to assess the risk to the future on-site commercial worker are based on the laboratory reporting limit for the soil sample obtained at D-4 (0'-3'). These laboratory reporting limits are greater than any reported concentration in the surficial soil samples obtained from the BLR portion of the Ray Avenue Superfund Site. Utilizing these reporting limits as exposure concentrations may potentially overestimate the risk to the future commercial worker.

The site wide hazard index for the future on-site commercial worker is 9E-02. The non-carcinogenic risk to the future on-site commercial worker is driven mostly by the concentration of arsenic in the surficial soil interval. The arsenic hazard quotients for ingestion (2.81E-02) and dermal contact (5.57E-03) account for approximately 38% of the site wide hazard index.

6.3 On-Site Construction Worker

The cumulative site wide IELCR for the on-site construction worker is 3E-04. As is the case with the future commercial worker, the carcinogenic risk to the future on-site commercial worker is driven mostly by the concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene in the soils. The cumulative benzo(a)pyrene and dibenzo(a,h)anthracene IELCRs for ingestion (1.98E-04) and dermal contact (8.36E-05) account for approximately 93% of the total site wide IELCR.

The concentration for five (5) of the PAHs utilized to access the risk to the on-site construction worker are based on the maximum laboratory limit (acenaphthene, anthracene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and fluorene). The maximum reporting limit was utilized for these chemicals of potential concern, since these reporting limits exceeded any laboratory reported concentrations. Utilizing the maximum reporting limit for these chemicals of potential concern may overestimate the risk to the on-site construction worker.

The site wide hazard index for the on-site construction worker is 4E-01. The non-carcinogenic risk to the on-site construction worker is driven mostly by the concentration of pyrene and arsenic in the soils. The cumulative hazard quotient for these chemicals for all exposure pathways (3.2E-01) account for approximately 80% of the site wide hazard index.

TABLE NO. 9
EXPOSURE CONCENTRATION/RISK EVALUATION
ON-SITE COMMERCIAL WORKER
4327 GUSTINE AVENUE

EXPOSURE CONCENTRATION

Chemicals of Potential Concern	Soil Concentration (mg/kg)	Ingestion		Inhalation		Dermal Contact	
		Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen
Acenaphthene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Anthracene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Benzo(a)anthracene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Benzo(a)pyrene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Benzo(b)fluoranthene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Benzo(k)fluoranthene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Chrysene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Dibenzo(a,h)anthracene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Fluoranthene	253	NA	2.48E-04	NA	NA	NA	2.12E-04
Fluorene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Indeno(1,2,3-cd)pyrene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Naphthalene	0.594	NA	5.81E-07	8.87E-04	2.48E-03	NA	4.99E-07
Pyrene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Arsenic	8.62	3.01E-06	8.43E-06	5.17E-07	1.45E-06	5.96E-07	1.67E-06
Chromium	36.6	1.28E-05	3.58E-05	2.19E-06	6.14E-06	NA	NA

RISK EVALUATION

Chemicals of Potential Concern	Soil Concentration (mg/kg)	Ingestion		Inhalation		Dermal Contact	
		IELCR	HQ	IELCR	HQ	IELCR	HQ
Acenaphthene	222	NA	3.62E-03	NA	NA	NA	3.11E-03
Anthracene	222	NA	7.24E-04	NA	NA	NA	6.21E-04
Benzo(a)anthracene	222	5.66E-05	NA	1.46E-09	NA	4.86E-05	NA
Benzo(a)pyrene	222	5.66E-04	NA	1.46E-08	NA	4.86E-04	NA
Benzo(b)fluoranthene	222	5.66E-05	NA	1.46E-09	NA	4.86E-05	NA
Benzo(k)fluoranthene	222	5.66E-06	NA	1.46E-09	NA	4.86E-06	NA
Chrysene	222	5.66E-07	NA	1.46E-10	NA	4.86E-07	NA
Dibenzo(a,h)anthracene	222	5.66E-04	NA	1.60E-08	NA	4.86E-04	NA
Fluoranthene	253	NA	6.19E-03	NA	NA	NA	5.31E-03
Fluorene	222	NA	5.43E-03	NA	NA	NA	4.66E-03
Indeno(1,2,3-cd)pyrene	222	5.66E-05	NA	1.46E-09	NA	4.86E-05	NA
Naphthalene	0.594	NA	2.91E-05	3.02E-08	8.28E-04	NA	2.49E-05
Pyrene	222	NA	7.24E-03	NA	NA	NA	6.21E-03
Arsenic	8.62	4.52E-06	2.81E-02	2.22E-09	9.65E-05	8.95E-07	5.57E-03
Chromium	36.6	6.40E-06	1.19E-02	1.84E-07	6.14E-05	NA	NA

Cumulative Pathway Risk	1.32E-03	6.33E-02	2.53E-07	9.86E-04	1.12E-03	2.55E-02
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SITE WIDE RISK

CUMULATIVE IELCR	2E-03
HAZARD INDEX	9E-02

TABLE NO. 10
EXPOSURE CONCENTRATION/RISK EVALUATION
ON-SITE CONSTRUCTION WORKER
4327 GUSTINE AVENUE

EXPOSURE CONCENTRATION

Chemicals of Potential Concern	Concentration	Ingestion		Inhalation		Dermal Contact	
		Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen
Acenaphthene	587	NA	1.98E-03	NA	NA	NA	7.71E-04
Anthracene	587	NA	1.98E-03	NA	NA	NA	7.71E-04
Benzo(a)anthracene	875	1.45E-05	NA	1.85E-04	NA	5.67E-06	NA
Benzo(a)pyrene	1050	1.74E-05	NA	2.22E-04	NA	6.80E-06	NA
Benzo(b)fluoranthene	1180	1.96E-05	NA	2.50E-04	NA	7.64E-06	NA
Benzo(k)fluoranthene	587	9.75E-06	NA	1.24E-04	NA	3.80E-06	NA
Chrysene	905	1.50E-05	NA	1.91E-04	NA	5.86E-06	NA
Dibenzo(a,h)anthracene	587	9.75E-06	NA	1.24E-04	NA	3.80E-06	NA
Fluoranthene	1230	NA	4.14E-03	NA	NA	NA	1.62E-03
Fluorene	587	NA	1.98E-03	NA	NA	NA	7.71E-04
Indeno(1,2,3-cd)pyrene	635	1.05E-05	NA	1.34E-04	NA	4.11E-06	NA
Naphthalene	0.594	NA	2.00E-06	2.15E-04	4.36E-02	NA	7.81E-07
Pyrene	1060	NA	3.57E-03	NA	NA	NA	1.39E-03
Arsenic	10.4	1.73E-07	3.50E-05	2.20E-06	4.46E-04	1.55E-08	3.15E-06
Chromium	36.6	6.08E-07	1.23E-04	7.74E-06	1.57E-03	NA	NA

RISK EVALUATION

Chemicals of Potential Concern	Concentration	Ingestion		Inhalation		Dermal Contact	
		IELCR	HQ	IELCR	HQ	IELCR	HQ
Acenaphthene	587	NA	3.30E-03	NA	NA	NA	1.29E-03
Anthracene	587	NA	1.98E-04	NA	NA	NA	7.71E-05
Benzo(a)anthracene	875	1.06E-05	NA	2.04E-08	NA	4.14E-06	NA
Benzo(a)pyrene	1050	1.27E-04	NA	2.44E-07	NA	4.96E-05	NA
Benzo(b)fluoranthene	1180	1.43E-05	NA	2.75E-08	NA	5.58E-06	NA
Benzo(k)fluoranthene	587	7.12E-07	NA	1.37E-08	NA	2.78E-07	NA
Chrysene	905	1.10E-07	NA	2.11E-09	NA	4.28E-08	NA
Dibenzo(a,h)anthracene	587	7.12E-05	NA	1.49E-07	NA	2.78E-05	NA
Fluoranthene	1230	NA	1.04E-02	NA	NA	NA	4.04E-03
Fluorene	587	NA	4.94E-03	NA	NA	NA	1.93E-03
Indeno(1,2,3-cd)pyrene	635	7.70E-06	NA	1.48E-08	NA	3.00E-06	NA
Naphthalene	0.594	NA	3.34E-06	7.31E-09	1.45E-02	NA	1.30E-06
Pyrene	1060	NA	1.19E-01	NA	NA	NA	4.64E-02
Arsenic	10.4	2.59E-07	1.17E-01	9.46E-09	2.98E-02	2.33E-08	1.05E-02
Chromium	36.6	3.04E-07	2.47E-02	6.50E-07	5.24E-03	NA	NA

Cumulative Pathway Risk	2.32E-04	2.79E-01	1.14E-06	4.95E-02	9.05E-05	6.43E-02
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SITE WIDE RISK

CUMULATIVE IELCR	3E-04
CUMULATIVE HQ	4E-01

EXHIBIT IV - ON-SITE CONSTRUCTION WORKER

Benzo(a)anthracene (Carcinogen) – 875 mg/kg

INGESTION

$$ExposureConc = \frac{CA \times IR \times EF \times ED}{BW \times AT_C}$$

$$IR_{soil} = \frac{330 \text{ mg}}{\text{day}} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 3.3E-04 \frac{\text{kg}}{\text{day}}$$

$$ExposureConc = \frac{875 \frac{\text{mg}}{\text{kg}} \times 3.3E-04 \frac{\text{kg}}{\text{day}} \times 90 \frac{\text{days}}{\text{year}} \times 1 \text{ year}}{70 \text{ kg} \times 70 \text{ years} \times 365 \frac{\text{days}}{\text{year}}}$$

$$ExposureConc = 1.45E-05 \frac{\text{mg}}{\text{kg-day}}$$

$$IELCR = ExposureConc \times SlopeFactor$$

$$IELCR = 1.45E-05 \frac{\text{mg}}{\text{kg-day}} \times 7.3E-01 \frac{\text{kg-day}}{\text{mg}}$$

$$IELCR = 1.06E-05$$

INHALATION (PARTICULATES)

$$ExposureConc = \frac{CA \times ET \times EF \times ED}{AT_C}$$

$$PEF = \frac{Q}{C_{sr}} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times \left(\frac{W}{3} \right)^{0.4} \times \frac{(365-p)}{365} \times \sum VKT} \right]$$

$$PEF = 23.02 \times \frac{1}{0.185} \times \left[\frac{2,592,000 \times 162.58}{556 \times \left(\frac{12.8}{3} \right)^{0.4} \times \frac{(365-112)}{365} \times 13.716} \right]$$

$$PEF = 5.55E06 \frac{m^3}{kg}$$

$$CA = \frac{Concentration}{PEF} = \frac{875 \frac{mg}{kg} \times \frac{1000 \mu g}{1mg}}{5.55E06 \frac{m^3}{kg}} = 0.1577 \frac{\mu g}{m^3}$$

$$ExposureConc = \frac{0.1577 \frac{\mu g}{m^3} \times 8 \frac{hours}{day} \times 90 \frac{days}{year} \times 1 year}{70 years \times 365 \frac{days}{year} \times 24 \frac{hours}{day}}$$

$$ExposureConc = 1.85E - 04 \frac{\mu g}{m^3}$$

$$IELCR = 1.85E - 04 \frac{\mu g}{m^3} \times 1.1E - 04 \frac{m^3}{\mu g}$$

$$IELCR = 2.04E - 08$$

DERMAL CONTACT

$$ExposureConc = \frac{CA \times SA \times M \times EF \times ED \times ABS_D}{BW \times AT_C}$$

$$M = 0.3 \frac{mg}{cm^2} \times \frac{1g}{1000mg} \times \frac{1kg}{1000g} = 3.00E - 07 \frac{kg}{cm^2}$$

$$ExposureConc = \frac{875 \frac{mg}{kg} \times 3300 cm^2 \times 3.00E - 07 \frac{kg}{cm^2} \times 90 \frac{days}{year} \times 1 year \times 1 \frac{event}{day} \times 0.13}{70kg \times 70 years \times 365 \frac{days}{year}}$$

$$ExposureConc = 5.67E - 06 \frac{mg}{kg - day}$$

$$IELCR = 5.67E - 06 \frac{mg}{kg - day} \times 7.3E - 01 \frac{kg - day}{mg}$$

$$IELCR = 4.14E - 06$$

ON-SITE CONSTRUCTION WORKER

Arsenic (Non-Carcinogen) – 10.4 mg/kg

INGESTION

$$ExposureConc = \frac{CA \times IR \times EF \times ED}{BW \times AT_{NC}}$$

$$IR_{soil} = \frac{330mg}{day} \times \frac{1g}{1000mg} \times \frac{1kg}{1000g} = 3.3E - 04 \frac{kg}{day}$$

$$ExposureConc = \frac{10.4 \frac{mg}{kg} \times 3.3E - 04 \frac{kg}{day} \times 90 \frac{days}{year} \times 1year}{70kg \times \frac{126days}{365 \frac{days}{year}} \times 365 \frac{days}{year}}$$

$$ExposureConc = 3.50E - 05 \frac{mg}{kg - day}$$

$$HQ = \frac{ExposureConc}{RfD}$$

$$HQ = \frac{3.50E - 05 \frac{mg}{kg - day}}{3.00E - 04 \frac{mg}{kg - day}}$$

$$HQ = 1.17E - 01$$

INHALATION (PARTICULATES)

$$ExposureConc = \frac{CA \times ET \times EF \times ED}{AT_C}$$

$$CA = \frac{Concentration}{PEF} = \frac{10.4 \frac{mg}{kg} \times \frac{1000\mu g}{1mg}}{\frac{5.55E06}{m^3} \frac{m^3}{kg}} = 1.87E - 03 \frac{\mu g}{m^3}$$

$$ExposureConc = \frac{1.87E-03 \frac{\mu g}{m^3} \times 8 \frac{hours}{day} \times 90 \frac{days}{year} \times 1 year}{\frac{126 days}{365 \frac{days}{year}} \times 365 \frac{days}{year} \times 24 \frac{hours}{day}}$$

$$ExposureConc = 4.46E-04 \frac{\mu g}{m^3}$$

$$HQ = \frac{4.46E-04 \frac{\mu g}{m^3}}{1.5E-05 \frac{mg}{m^3} \times \frac{1000 \mu g}{1 mg}}$$

$$HQ = 2.98E-02$$

DERMAL CONTACT

$$ExposureConc = \frac{CA \times SA \times M \times EF \times ED \times ABS_D}{BW \times AT_{NC}}$$

$$M = 0.3 \frac{mg}{cm^2} \times \frac{1g}{1000mg} \times \frac{1kg}{1000g} = 3.00E-07 \frac{kg}{cm^2}$$

$$ExposureConc = \frac{10.4 \frac{mg}{kg} \times 3300 cm^2 \times 3.00E-07 \frac{kg}{cm^2} \times 90 \frac{days}{year} \times 1 year \times 1 \frac{event}{day} \times 0.03}{70 kg \times \frac{126 days}{365 \frac{days}{year}} \times 365 \frac{days}{year}}$$

$$ExposureConc = 3.15E-06 \frac{mg}{kg-day}$$

$$HQ = \frac{3.15E-06 \frac{mg}{kg-day}}{3.0E-04 \frac{mg}{kg-day}}$$

$$HQ = 1.05E-02$$

Equation 5-14
 Derivation of the Subchronic Volatilization Factor
 Construction Scenario

CHEMICAL SPECIFIC PARAMETERS

Chemical :	<u>Naphthalene</u>
Organic Carbon Partition Coefficient (K_{OC})	<u>2.00E+03</u> L/kg
Henry's Law Constant (H')	<u>1.98E-02</u>
Diffusivity in Water (D_w)	<u>7.50E-06</u> cm ² /s
Diffusivity in Air (D_i)	<u>5.90E-02</u> cm ² /s

SITE SPECIFIC PARAMETERS

Organic Carbon Content of Soil (f_{OC})	<u>0.006</u> g/g
Air-Filled Soil Porosity (θ_A)	<u>0.2840</u>
Water Filled Soil Porosity (θ_W)	<u>0.1500</u>
Total Soil Porosity (η)	<u>0.4340</u>
Dry Soil Bulk Density (ρ_b)	<u>1.5</u> g/cc
Soil Partical Density (ρ_s)	<u>2.65</u> g/cc
Inverse Mean Conc at Center of Sq Source (Q/C)	<u>14.31</u> (g/m ² -s)/(kg/m ³)
Exposure Interval (T)	<u>2.59E+06</u> seconds
Dispersion Correction Factor (F_d)	<u>0.185</u>

$$K_d = K_{OC} \times f_{OC}$$

$$K_d = \frac{12.00}{cm^3/g}$$

$$D_A = \frac{[(\Theta_a^{10/3} D_i H') + \Theta_w^{10/3} D_w] / \eta^2}{\rho_b K_d + \Theta_w + \Theta_a \times H'}$$

$$D_A = \frac{5.15E-06}{cm^2/s}$$

Equation 5-14

$$VF_{sc} = \left[\frac{(3.14 \times D_A \times T)^{1/2}}{2 \times \rho_b \times D_A} \right] \times 10^{-4} \frac{m^2}{cm^2} \times \frac{Q}{C_{sa}} \times \frac{1}{F_D}$$

$$VF = \frac{3242.61}{m^3/kg}$$

TABLE NO. 9
EXPOSURE CONCENTRATION/RISK EVALUATION
ON-SITE COMMERCIAL WORKER
4327 GUSTINE AVENUE

EXPOSURE CONCENTRATION

Chemicals of Potential Concern	Soil Concentration (mg/kg)	Ingestion		Inhalation		Dermal Contact	
		Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen
Acenaphthene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Anthracene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Benzo(a)anthracene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Benzo(a)pyrene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Benzo(b)fluoranthene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Benzo(k)fluoranthene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Chrysene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Dibenzo(a,h)anthracene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Fluoranthene	253	NA	2.48E-04	NA	NA	NA	2.12E-04
Fluorene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Indeno(1,2,3-cd)pyrene	222	7.76E-05	NA	1.33E-05	NA	6.66E-05	NA
Naphthalene	0.594	NA	5.81E-07	8.87E-04	2.48E-03	NA	4.99E-07
Pyrene	222	NA	2.17E-04	NA	NA	NA	1.86E-04
Arsenic	8.62	3.01E-06	8.43E-06	5.17E-07	1.45E-06	5.96E-07	1.67E-06
Chromium	36.6	1.28E-05	3.58E-05	2.19E-06	6.14E-06	NA	NA

RISK EVALUATION

Chemicals of Potential Concern	Soil Concentration (mg/kg)	Ingestion		Inhalation		Dermal Contact	
		IELCR	HQ	IELCR	HQ	IELCR	HQ
Acenaphthene	222	NA	3.62E-03	NA	NA	NA	3.11E-03
Anthracene	222	NA	7.24E-04	NA	NA	NA	6.21E-04
Benzo(a)anthracene	222	5.66E-05	NA	1.46E-09	NA	4.86E-05	NA
Benzo(a)pyrene	222	5.66E-04	NA	1.46E-08	NA	4.86E-04	NA
Benzo(b)fluoranthene	222	5.66E-05	NA	1.46E-09	NA	4.86E-05	NA
Benzo(k)fluoranthene	222	5.66E-06	NA	1.46E-09	NA	4.86E-06	NA
Chrysene	222	5.66E-07	NA	1.46E-10	NA	4.86E-07	NA
Dibenzo(a,h)anthracene	222	5.66E-04	NA	1.60E-08	NA	4.86E-04	NA
Fluoranthene	253	NA	6.19E-03	NA	NA	NA	5.31E-03
Fluorene	222	NA	5.43E-03	NA	NA	NA	4.66E-03
Indeno(1,2,3-cd)pyrene	222	5.66E-05	NA	1.46E-09	NA	4.86E-05	NA
Naphthalene	0.594	NA	2.91E-05	3.02E-08	8.28E-04	NA	2.49E-05
Pyrene	222	NA	7.24E-03	NA	NA	NA	6.21E-03
Arsenic	8.62	4.52E-06	2.81E-02	2.22E-09	9.65E-05	8.95E-07	5.57E-03
Chromium	36.6	6.40E-06	1.19E-02	1.84E-07	6.14E-05	NA	NA

Cumulative Pathway Risk	1.32E-03	6.33E-02	2.53E-07	9.86E-04	1.12E-03	2.55E-02
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SITE WIDE RISK

CUMULATIVE IELCR	2E-03
HAZARD INDEX	9E-02

INGESTION

Chemical	C/NC	Concentration	Carcenogen			No.
			Dose	Oral SF	IELCR	
Acenaphthene	NC	222				2.17E-04
Anthracene	NC	222				2.17E-04
Benzo(a)anthracene	C	222	7.76E-05	7.30E-01	5.66E-05	
Benzo(a)pyrene	C	222	7.76E-05	7.30E+00	5.66E-04	
Benzo(b)fluoranthene	C	222	7.76E-05	7.30E-01	5.66E-05	
Benzo(k)fluoranthene	C	222	7.76E-05	7.30E-02	5.66E-06	
Chrysene	C	222	7.76E-05	7.30E-03	5.66E-07	
Dibenzo(a,h)anthracene	C	222	7.76E-05	7.30E+00	5.66E-04	
Fluoranthene	NC	253				2.48E-04
Fluorene	NC	222				2.17E-04
Indeno(1,2,3-cd)pyrene	C	222	7.76E-05	7.30E-01	5.66E-05	
Naphthalene	C/NC	0.594				5.81E-07
Pyrene	NC	222				2.17E-04
Arsenic	C/NC	8.62	3.01E-06	1.50E+00	4.52E-06	8.43E-06
Chromium	C/NC	36.6	1.28E-05	5.00E-01	6.40E-06	3.58E-05

INHALE

Chemical	C/NC	Concentration	Carcenogen			No.
			Dose	Inhale SF	IELCR	
Acenaphthene	NC	222				
Anthracene	NC	222				
Benzo(a)anthracene	C	222	1.33E-05	1.10E-04	1.46E-09	
Benzo(a)pyrene	C	222	1.33E-05	1.10E-03	1.46E-08	
Benzo(b)fluoranthene	C	222	1.33E-05	1.10E-04	1.46E-09	
Benzo(k)fluoranthene	C	222	1.33E-05	1.10E-04	1.46E-09	
Chrysene	C	222	1.33E-05	1.10E-05	1.46E-10	
Dibenzo(a,h)anthracene	C	222	1.33E-05	1.20E-03	1.60E-08	
Fluoranthene	NC	253				
Fluorene	NC	222				
Indeno(1,2,3-cd)pyrene	C	222	1.33E-05	1.10E-04	1.46E-09	
Naphthalene	C/NC	0.594	8.87E-04	3.40E-05	3.02E-08	2.48E-03
Pyrene	NC	222				
Arsenic	C/NC	8.62	5.17E-07	4.30E-03	2.22E-09	1.45E-06
Chromium	C/NC	36.6	2.19E-06	8.40E-02	1.84E-07	6.14E-06

DERMAL CONTACT

Chemical	C/NC	Concentration	Carcenogen			No.
			Dose	Dermal SF	IELCR	
Acenaphthene	NC	222				1.86E-04
Anthracene	NC	222				1.86E-04
Benzo(a)anthracene	C	222	6.66E-05	7.30E-01	4.86E-05	
Benzo(a)pyrene	C	222	6.66E-05	7.30E+00	4.86E-04	
Benzo(b)fluoranthene	C	222	6.66E-05	7.30E-01	4.86E-05	
Benzo(k)fluoranthene	C	222	6.66E-05	7.30E-02	4.86E-06	
Chrysene	C	222	6.66E-05	7.30E-03	4.86E-07	

Dibenzo(a,h)anthracene	C	222	6.66E-05	7.30E+00	4.86E-04	
Fluoranthene	NC	253				2.12E-04
Fluorene	NC	222				1.86E-04
Indeno(1,2,3-cd)pyrene	C	222	6.66E-05	7.30E-01	4.86E-05	
Naphthalene	C/NC	0.594				4.99E-07
Pyrene	NC	222				1.86E-04
Arsenic	C/NC	8.62	5.96E-07	1.50E+00	8.95E-07	1.67E-06
Chromium	C/NC	36.6				

On-Carcenogens	
RfD	HQ
6.00E-02	3.62E-03
3.00E-01	7.24E-04
4.00E-02	6.19E-03
4.00E-02	5.43E-03
2.00E-02	2.91E-05
3.00E-02	7.24E-03
3.00E-04	2.81E-02
3.00E-03	1.19E-02

Non-Carcinogens	
RfC	HQ
3.00E-03	8.28E-04
1.50E-05	9.65E-05
1.00E-04	6.14E-05

Non-Carcinogens	
RfD	HQ
6.00E-02	3.11E-03
3.00E-01	6.21E-04

4.00E-02	5.31E-03
4.00E-02	4.66E-03
2.00E-02	2.49E-05
3.00E-02	6.21E-03
3.00E-04	5.57E-03

TABLE NO. 10
EXPOSURE CONCENTRATION/RISK EVALUATION
ON-SITE CONSTRUCTION WORKER
4327 GUSTINE AVENUE

EXPOSURE CONCENTRATION

Chemicals of Potential Concern	Concentration	Ingestion		Inhalation		Dermal Contact	
		Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen
Acenaphthene	587	NA	1.98E-03	NA	NA	NA	7.71E-04
Anthracene	587	NA	1.98E-03	NA	NA	NA	7.71E-04
Benzo(a)anthracene	875	1.45E-05	NA	1.85E-04	NA	5.67E-06	NA
Benzo(a)pyrene	1050	1.74E-05	NA	2.22E-04	NA	6.80E-06	NA
Benzo(b)fluoranthene	1180	1.96E-05	NA	2.50E-04	NA	7.64E-06	NA
Benzo(k)fluoranthene	587	9.75E-06	NA	1.24E-04	NA	3.80E-06	NA
Chrysene	905	1.50E-05	NA	1.91E-04	NA	5.86E-06	NA
Dibenzo(a,h)anthracene	587	9.75E-06	NA	1.24E-04	NA	3.80E-06	NA
Fluoranthene	1230	NA	4.14E-03	NA	NA	NA	1.62E-03
Fluorene	587	NA	1.98E-03	NA	NA	NA	7.71E-04
Indeno(1,2,3-cd)pyrene	635	1.05E-05	NA	1.34E-04	NA	4.11E-06	NA
Naphthalene	0.594	NA	2.00E-06	2.15E-04	4.36E-02	NA	7.81E-07
Pyrene	1060	NA	3.57E-03	NA	NA	NA	1.39E-03
Arsenic	10.4	1.73E-07	3.50E-05	2.20E-06	4.46E-04	1.55E-08	3.15E-06
Chromium	36.6	6.08E-07	1.23E-04	7.74E-06	1.57E-03	NA	NA

RISK EVALUATION

Chemicals of Potential Concern	Concentration	Ingestion		Inhalation		Dermal Contact	
		IELCR	HQ	IELCR	HQ	IELCR	HQ
Acenaphthene	587	NA	3.30E-03	NA	NA	NA	1.29E-03
Anthracene	587	NA	1.98E-04	NA	NA	NA	7.71E-05
Benzo(a)anthracene	875	1.06E-05	NA	2.04E-08	NA	4.14E-06	NA
Benzo(a)pyrene	1050	1.27E-04	NA	2.44E-07	NA	4.96E-05	NA
Benzo(b)fluoranthene	1180	1.43E-05	NA	2.75E-08	NA	5.58E-06	NA
Benzo(k)fluoranthene	587	7.12E-07	NA	1.37E-08	NA	2.78E-07	NA
Chrysene	905	1.10E-07	NA	2.11E-09	NA	4.28E-08	NA
Dibenzo(a,h)anthracene	587	7.12E-05	NA	1.49E-07	NA	2.78E-05	NA
Fluoranthene	1230	NA	1.04E-02	NA	NA	NA	4.04E-03
Fluorene	587	NA	4.94E-03	NA	NA	NA	1.93E-03
Indeno(1,2,3-cd)pyrene	635	7.70E-06	NA	1.48E-08	NA	3.00E-06	NA
Naphthalene	0.594	NA	3.34E-06	7.31E-09	1.45E-02	NA	1.30E-06
Pyrene	1060	NA	1.19E-01	NA	NA	NA	4.64E-02
Arsenic	10.4	2.59E-07	1.17E-01	9.46E-09	2.98E-02	2.33E-08	1.05E-02
Chromium	36.6	3.04E-07	2.47E-02	6.50E-07	5.24E-03	NA	NA

Cumulative Pathway Risk	2.32E-04	2.79E-01	1.14E-06	4.95E-02	9.05E-05	6.43E-02
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SITE WIDE RISK

CUMULATIVE IELCR	3E-04
CUMULATIVE HQ	4E-01

INGESTION

Chemical	C/NC	Concentration	Carcenogen			Non-Dose
			Dose	Oral SF	IELCR	
Acenaphthene	NC	587				1.98E-03
Anthracene	NC	587				1.98E-03
Benzo(a)anthracene	C	875	1.45E-05	7.30E-01	1.06E-05	
Benzo(a)pyrene	C	1,050	1.74E-05	7.30E+00	1.27E-04	
Benzo(b)fluoranthene	C	1,180	1.96E-05	7.30E-01	1.43E-05	
Benzo(k)fluoranthene	C	587	9.75E-06	7.30E-02	7.12E-07	
Chrysene	C	905	1.50E-05	7.30E-03	1.10E-07	
Dibenzo(a,h)anthracene	C	587	9.75E-06	7.30E+00	7.12E-05	
Fluoranthene	NC	1230				4.14E-03
Fluorene	NC	587				1.98E-03
Indeno(1,2,3-cd)pyrene	C	635	1.05E-05	7.30E-01	7.70E-06	
Naphthalene	C/NC	0.594				2.00E-06
Pyrene	NC	1060				3.57E-03
Arsenic	C/NC	10.4	1.73E-07	1.50E+00	2.59E-07	3.50E-05
Chromium	C/NC	36.6	6.08E-07	5.00E-01	3.04E-07	1.23E-04

INHALE

Chemical	C/NC	Concentration	Carcenogen			Non-Dose
			Dose	Inhale SF	IELCR	
Acenaphthene	NC	587				
Anthracene	NC	587				
Benzo(a)anthracene	C	875	1.85E-04	1.10E-04	2.04E-08	
Benzo(a)pyrene	C	1,050	2.22E-04	1.10E-03	2.44E-07	
Benzo(b)fluoranthene	C	1,180	2.50E-04	1.10E-04	2.75E-08	
Benzo(k)fluoranthene	C	587	1.24E-04	1.10E-04	1.37E-08	
Chrysene	C	905	1.91E-04	1.10E-05	2.11E-09	
Dibenzo(a,h)anthracene	C	587	1.24E-04	1.20E-03	1.49E-07	
Fluoranthene	NC	1230				
Fluorene	NC	587				
Indeno(1,2,3-cd)pyrene	C	635	1.34E-04	1.10E-04	1.48E-08	
Naphthalene	C/NC	0.594	2.15E-04	3.40E-05	7.31E-09	4.36E-02
Pyrene	NC	1060				
Arsenic	C/NC	10.4	2.20E-06	4.30E-03	9.46E-09	4.46E-04
Chromium	C/NC	36.6	7.74E-06	8.40E-02	6.50E-07	1.57E-03

INHALE

Chemical	C/NC	Concentration	Carcenogen			Non-Dose
			Dose	Dermal SF	IELCR	
Acenaphthene	NC	587				7.71E-04
Anthracene	NC	587				7.71E-04
Benzo(a)anthracene	C	875	5.67E-06	7.30E-01	4.14E-06	
Benzo(a)pyrene	C	1,050	6.80E-06	7.30E+00	4.96E-05	
Benzo(b)fluoranthene	C	1,180	7.64E-06	7.30E-01	5.58E-06	
Benzo(k)fluoranthene	C	587	3.80E-06	7.30E-02	2.78E-07	
Chrysene	C	905	5.86E-06	7.30E-03	4.28E-08	
Dibenzo(a,h)anthracene	C	587	3.80E-06	7.30E+00	2.78E-05	

Fluoranthene	NC	1230				1.62E-03
Fluorene	NC	587				7.71E-04
Indeno(1,2,3-cd)pyrene	C	635	4.11E-06	7.30E-01	3.00E-06	
Naphthalene	C/NC	0.594				7.81E-07
Pyrene	NC	1060				1.39E-03
Arsenic	C/NC	10.4	1.55E-08	1.50E+00	2.33E-08	3.15E-06
Chromium	C/NC	36.6				

Carcenogens	
RfD	HQ
6.00E-01	3.30E-03
1.00E+01	1.98E-04
4.00E-01	1.04E-02
4.00E-01	4.94E-03
6.00E-01	3.34E-06
3.00E-02	1.19E-01
3.00E-04	1.17E-01
5.00E-03	2.47E-02

Carcenogens	
RfC	HQ
3.00E-03	1.45E-02
1.50E-05	2.98E-02
3.00E-04	5.24E-03

4.00E-01	4.04E-03
4.00E-01	1.93E-03
6.00E-01	1.30E-06
3.00E-02	4.64E-02
3.00E-04	1.05E-02